

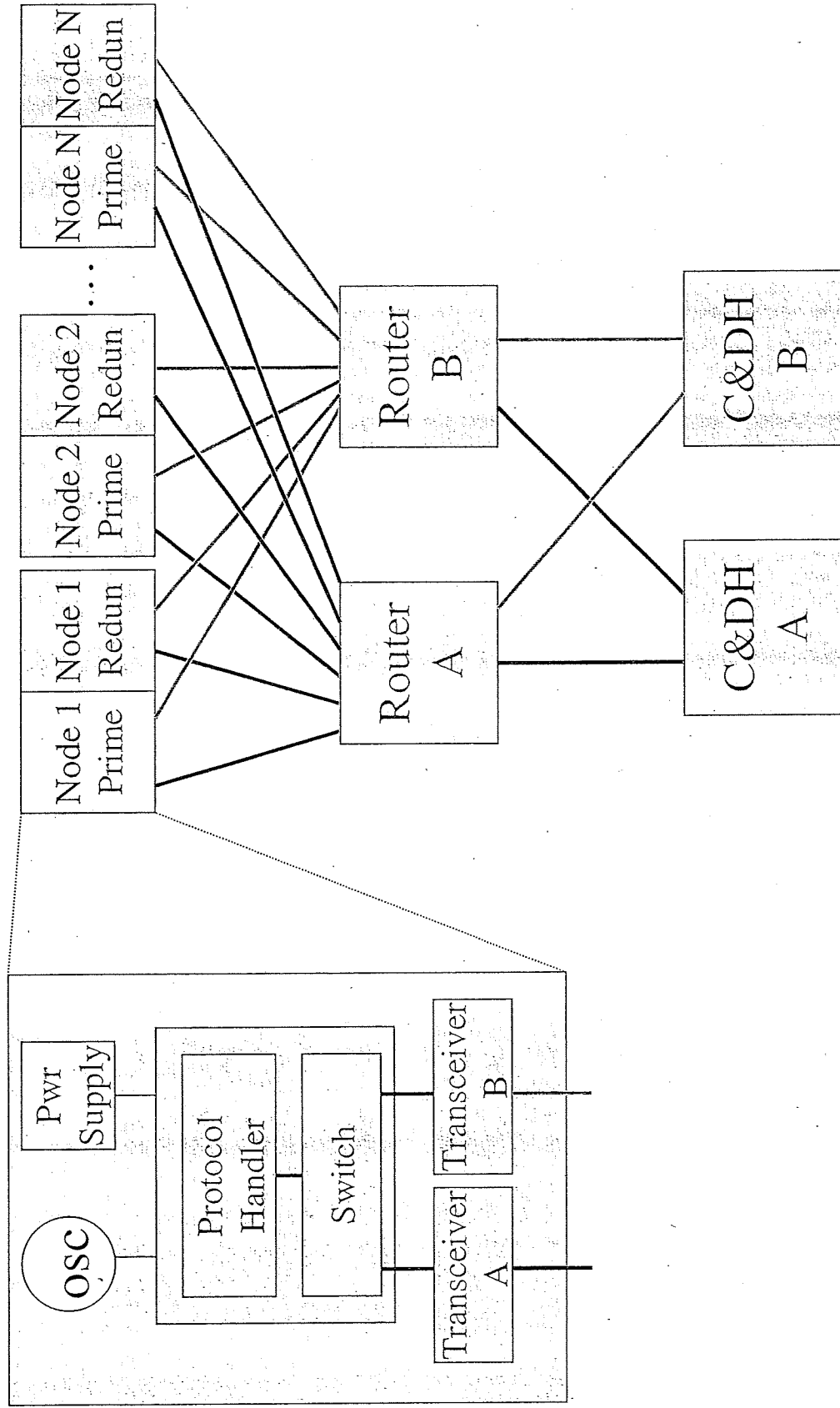
Proposed SpaceWire Redundancy Mechanism

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SpaceWire Working Group Meeting
ESA-ESTEC Noordwijk, Netherlands
January 17-18, 2007*

Proposed Redundancy Mechanism Update

- Presentation made at 2006 MAPLD SpaceWire Seminar
- Proposal discussed at SpaceWire Steering Committee meeting at 2006 MAPLD
 - Action: Provide reliability rationale for proposal
- Reliability for of interconnection approach needs to be view at system level
- Cross-connected systems are common for redundant components
- Steve Parkes at 2006 MAPLD SpW Seminar also presented architectures that showed redundancy at physical level for a single protocol handler
 - There is some consensus for SpW Physical level redundancy
 - But no standardized mechanism for how to switch between redundant links
 - Question – What makes decision as to when to switch between redundant links?
 - Upper layer?
 - Based upon packet activity or acknowledgment (outside SpaceWire standard)
 - SpaceWire?
 - Based upon connection status

Cross-Connected Redundancy Model



Rationale

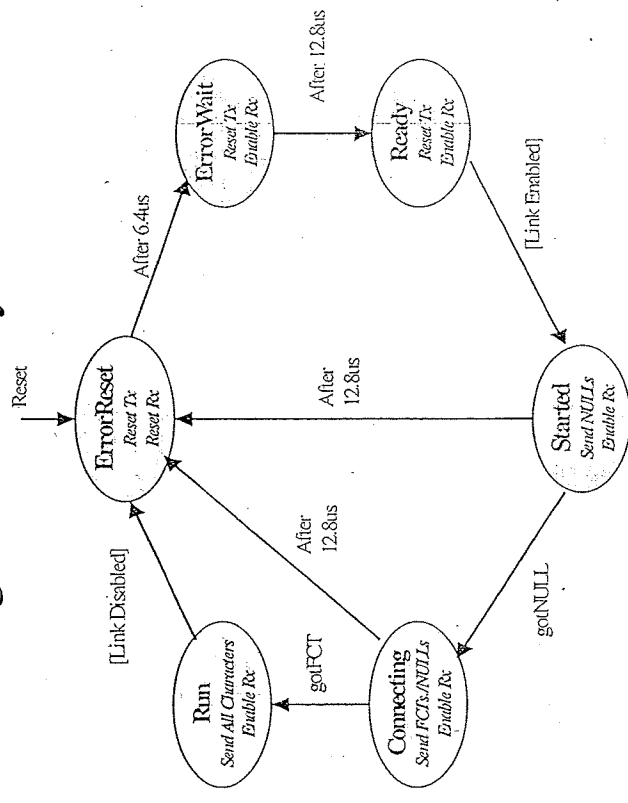
- The proposed (or similar) SpW redundancy mechanism will be necessary for SpW cross-connected systems if a single protocol handler is multiplexed over 2 redundant links
 - Reduces the amount of logic
 - Simpler from an application viewpoint
- Scenario (refer to diagram on previous slide):
 - A) C&DH A is on and C&DH B is off
 - B) Failure causes C&DH to switch from A to B
 - C) SpW I/F at Router will need to detect switch over from C&DH A to B
 - SpaceWire requires hand shaking between both sides of link to connect and must have a mechanism to switch connections at Router SpW I/F

Backup - Link Initialization (Background)

- SpW initialization is important for understanding redundancy mechanism

• SpW initialization State Machine (SM)

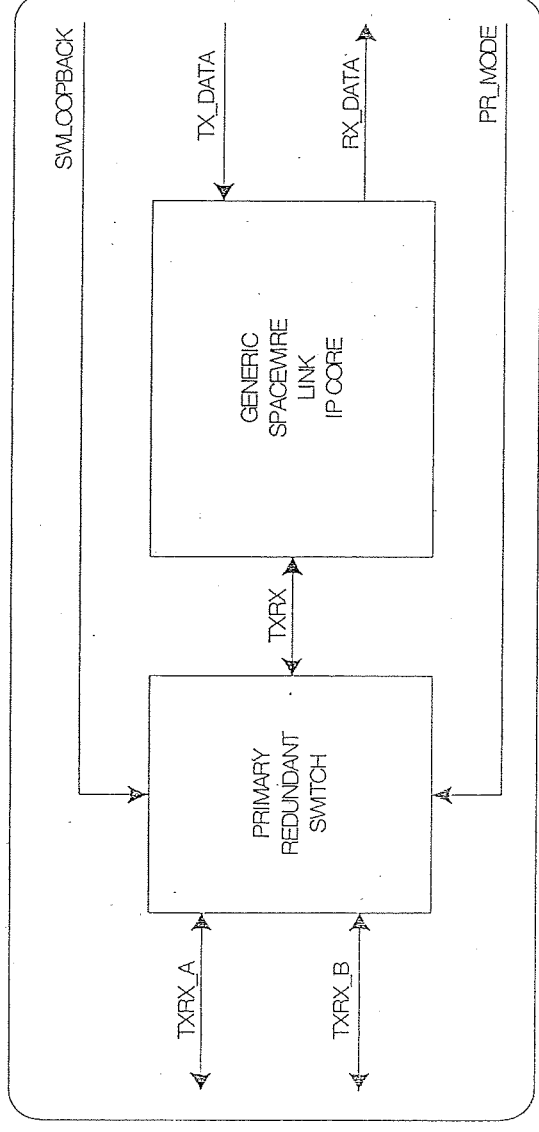
- Resets
- Then..waits
- Then..listens
- If enabled - attempt to synchronize
 - Transmits synchronization characters
- If synchronized
 - Exchanges flow control information
 - Rx buffer size
 - Then..exchanges Data and all other necessary characters



- SpW SM has 2 end results
 - Connection established
 - Run State
 - Connection failed
 - Back to Error Reset

Backup - Primary Redundant Block Diagram

- Redundancy does not replicate protocol logic
 - Less logic
 - Same user (back-end) interface as if there were no redundancy
 - Tx FIFO & Rx FIFO
 - Transparent to user interface
- Multiplexer (switch) to steer serial stream between cables



Backup - Multiplexer Steering Mechanism

- The multiplexer is controlled by a new SM
 - Primary/Redundant (Prim/Redun) SM
 - No user intervention
- Prim/Redun SM keeps track of how many times “connection failed” for the Link Initialization SM
- Prim/Redun SM switches multiplexer after X number of “connection failed” attempts for the same cable
 - Toggles cables
 - Primary
 - Redundant
 - X equals
 - 2
 - 5

Backup - Search Modes

- Prim/Redun SM may be programmed to operated in 4 different modes
- 2 modes compatible with SpW standard
 - “00” - Always Select Primary Link
 - “01” - Always Select Redundant Link
- 2 search modes not compatible with SpW standard
 - “10” – Ping-pong every 2 attempts to connect
 - “11” – Ping-pong every 5 attempts to connect
- Search modes are used to ping-pong between cables if connection fails to establish

PRMode	Description
“00”	Always Select Primary Link
“01”	Always Select Redundant Link
“10”	Ping-pong every 2 attempts to connect.
“11”	Ping-pong every 5 attempts to connect.

End